XXXIII. *Note on Archdeacon* PRATT'S *Paper "On the Effect of Local Attraction in the English Arc." By Captain* A. R. CLARKE, *R.E. Communicated by Lieut.-Colonel* JAMES, *R.E.*

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THE distances between the parallels of latitude of the principal stations of the original English Arc, as used by Archdeacon PRATT in his paper "On the Effects of Local Attraction*," are taken from the second and third volumes of the "Account of the Trigonometrical Survey." The correct distances, with the exception of that for Blenheim, are given at page 732 of the last published volume† of the Ordnance Survey. They are as follows:—

	Feet.
Dunnose and Greenwich	313716·9
Greenwich and Blenheim	132802·0
Blenheim and Arbury Hill	139837·4
Arbury Hill and Clifton	450225·2
Clifton and Burleigh Moor	406596·9

The distance, Greenwich to Bleinheim, is not altered, as there is no new determination of that quantity. The quantities λ and μ, as used by Archdeacon PRATT, do not require alteration.

The following Table exhibits the values of E and A for the several arcs:—

Arc.	Values of E.	Values of A.
1.	0·18568	·00985408
2.	0·15446	·00984849
3.	0·13546	·00987075
4.	0·09455	·00986928
5.	0·03572	·00986262

* Published in the Philosophical Transactions for 1856, Part I. p. 31.

† "Account of the Observations and Calculations of the Principal Triangulation, and of the Figure, Dimensions, and Mean Specific Gravity of the Earth as deduced therefrom." Published by Order of the Master-General and Board of Ordnance. London, 1858.

From this, taking the arcs two and two, we obtain the following results:—

Arcs compared.	Ellipticity deduced.
1st and 2nd	+0·01818
1st and 3rd	−0·03363
1st and 4th	−0·01690
1st and 5th	−0·00577
2nd and 3rd	−0·11869
2nd and 4th	−0·03516
2nd and 5th	−0·01207
3rd and 4th	+0·00364
3rd and 5th	+0·00825
4th and 5th	+0·01148
Mean value . . .	$= -0{\cdot}018067 = -\frac{1}{55{\cdot}350}$.

The value obtained by Archdeacon PRATT is . . . . . $-\frac{1}{47{\cdot}6846}$.

Taking for the elements of the mean meridian of the earth the values adopted by Archdeacon PRATT, viz.—

$$a = 20923713 \text{ feet} \quad . \quad . \quad . \quad . \quad \varepsilon = \frac{1}{300{\cdot}8},$$

we obtain for the different arcs the following values of A:—

1st arc, value of A=·00986403
2nd arc, value of A=·00986301
3rd arc, value of A=·00986238
4th arc, value of A=·00986104
5th arc, value of A=·00985911

If we take the differences between these and the values before deduced, we have

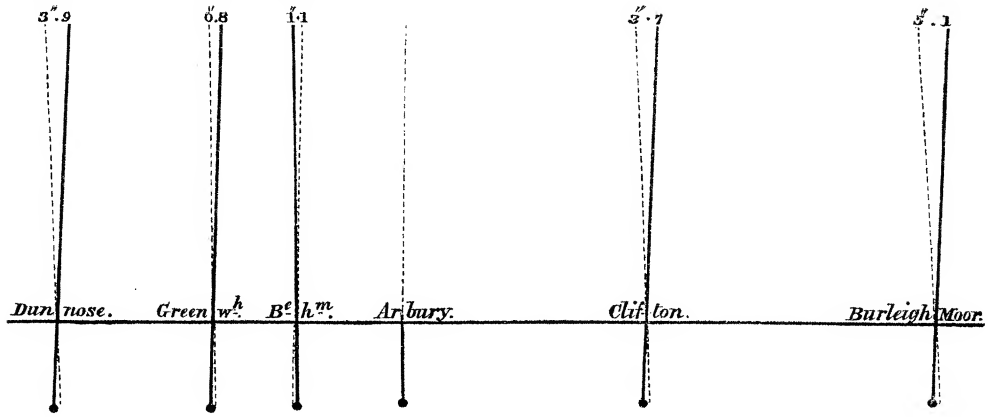
1st arc, defect of A below the mean=·00000995
2nd arc, defect of A below the mean=·00001452
3rd arc, excess of A above the mean=·00000837
4th arc, excess of A above the mean=·00000824
5th arc, excess of A above the mean=·00000351.

These quantities, multiplied by the lengths of the several arcs, give the following:—

1st arc: amplitude is in *defect* 3″·121
2nd arc: amplitude is in *defect* 1·928
3rd arc: amplitude is in *excess* 1·170
4th arc: amplitude is in *excess* 3·710
5th arc: amplitude is in *excess* 1·427

which are considerably smaller than the values obtained by Archdeacon PRATT from the data of the original work.

The diagram at page 35 of the paper referred to, will, by the substitution of the quantities just obtained, be changed to the following:



From the 'Account of the Principal Triangulation,' page 712, it appears, however, that the most probable deflections are—

At Dunnose	1″·117 South.
At Greenwich . . .	1·864 North.
At Arbury	2·226 North.
At Clifton	2·447 South.
At Burleigh Moor . .	3·589 South.

These values result from the comparison of all the geodetical and astronomical determinations in Great Britain and Ireland. When the English arc is used in the determination of the figure of the earth, in combination with the measurements in other countries, the following system of quantities is obtained (pages 764, 765):—

At Dunnose	1″·767 South.
At Greenwich . . .	1·270 North.
At Arbury	1·692 North.
At Clifton	2·864 South.
At Burleigh Moor . .	3·885 South.

From this it will be seen that the "rough approximation" of Archdeacon PRATT (at page 46 of his paper), namely, the determination of the local attraction at Burleigh Moor from the form of the masses of hill in the neighbourhood, is exceedingly near the truth. He finds 3″·660 South, which is intermediate to the quantities quoted above, viz. 3″·589 and 3″·885; but the values assigned at page 47 for the deflections at the other stations are not correctly inferred.